

CLAIMS

What is claimed is:

1. A system comprising:
a home node that provides a transaction reference to a requester in response to a request from the requester; and
the requester providing an acknowledgement message to the home node in response to the transaction reference, the transaction reference enabling the requester to determine an order of requests at the home node relative to the request from the requester.
2. The system of claim 1, wherein the home node provides a snoop associated with the request from the requester substantially in parallel with providing the transaction reference.
3. The system of claim 1, wherein the system employs a null-directory cache coherency protocol, the home node providing a transaction reference for each request to the home node.
4. The system of claim 1, wherein the system employs a directory-based cache coherency protocol, the home node providing a transaction reference for a selected subset of requests to the home node.
5. The system of claim 4, wherein the selected subset of requests to the home node comprises write requests and requests in response to which the home node generates at least one snoop.
6. The system of claim 4, wherein the requester is configured to employ data received in response to the request from the requester for a single use if the requester receives an invalidate command before receiving a copy of the data in response to the request from the requester and when a transaction reference has not yet been received by the requester.
7. The system of claim 1, wherein the home node further comprises a transaction resource that maintains transaction information associated with each of a plurality of requests to the home node, the transaction information including an indication of whether the requester has received the transaction reference associated with the request from the requester

and an indication of whether a response has been received for each snoop issued by the home node in response to the request from the requester.

8. The system of claim 1, wherein the requester comprises a first requester that provides a first request for data to the home node, the system further comprising a second requester that provides a second request for the data to the home node, the home node receiving the second request for the data subsequent to the first request for the data.

9. The system of claim 8, wherein the home node is programmed to issue a transaction reference associated with the second request based on transaction information at the home node associated with the first request indicating that the first request from has been completed.

10. The system of claim 9, wherein the transaction information at the home node associated with the first request further comprises an indication that the transaction reference has been received by the first requester and an indication that the home node has received a complete set of at least one response to each of at least one snoop provided by the home node in response to the first request.

11. The system of claim 1, wherein the requester further comprises a processor having a miss address file that includes an entry associated with the request from the requester, wherein a transaction reference field in the entry associated with the request from the requester is set in response to the transaction reference from the home node.

12. The system of claim 11, wherein the processor further comprises a queue, the requester controlling whether a snoop for data from the home node is placed in the queue based on the transaction reference field.

13. The system of claim 12, wherein the processor further comprises an associated cache that includes a plurality of cache lines, the requester is configured to provide a response to the snoop for the data from the home node based on a present state of the data in a respective one of the cache lines if the transaction reference field is not set when the snoop for the data from the home node is received by the requester.

14. The system of claim 12, wherein the processor further comprises an associated cache that includes a plurality of cache lines, the requester is configured to place the snoop for the data from the home node in the queue for deferring a response if the transaction reference field is set when the snoop for the data from the home node is received by the requester.
15. The system of claim 1, wherein the system comprises an unordered network.
16. A multi-processor system comprising:
 - a first requesting processor that provides a first request for data to a home node;
 - a second requesting processor that provides a second request for the data to the home node; and
 - the home node comprising a transaction resource for managing requests for the data, the home providing a transaction reference message to one of the first and second requesting processors, the one of the first and second requesting processors employing the transaction reference message to ascertain a relative order of the first and second requests for the data ordered at the home node.
17. The system of claim 16, wherein the first request is ordered at the home node preceding the second request and the first requesting processor is the one of the first and second requesting processors, the first requesting processor further comprises a transaction reference field associated with the first request from the requester that is set in response to the transaction reference message to enable the first requesting processor to ascertain an order of at least one request for the data from the home node relative to the first request at the home node.
18. The system of claim 17, wherein the first requesting processor further comprises a queue, the first requesting processor controlling whether a third request for the data from the home node is placed in the queue based on the transaction reference field.
19. The system of claim 18, wherein the third request for the data comprises a forward request provided by the home node in response to the second request for the data.

20. The system of claim 18, wherein the first requesting processor is configured (i) to provide a response to the third request based on a present state of the data in a respective one of the cache lines if the transaction reference field is not set when the third request is received and (ii) to place at least a portion of the third request for the data from the home node in the queue for deferring a response if the transaction reference field is set when the third request is received.

21. The system of claim 16, wherein the system employs a null-directory cache coherency protocol, the home node providing a transaction reference for each request for the data to the home node, the home node providing a forward request substantially in parallel with the transaction reference to each other processor in the system corresponding to the request from the one of the first and second requesting processors.

22. The system of claim 16, wherein the system employs a directory-based cache coherency protocol, the home node providing a transaction reference for a selected subset of requests for the data to the home node.

23. The system of claim 22, wherein the home node further comprises a directory that includes directory state information associated with the data, the home node is configured (i) to provide a forward request substantially in parallel with the transaction reference to at least one other processor in the system corresponding to the request from the one of the first and second requesting processors if the directory state information indicates that the data is cached at the at least one other processor in the system, and (ii) to provide a data response to the one of the first and second requesting processors if the directory state information indicates that the data is not cached in the system.

24. The system of claim 23, wherein the one of the first and second requesting processors is configured to employ data received in response to the request from the requester for a single use if the requester receives an invalidate command before the data is received in response to the request from the one of the first and second requesting processors and if a transaction reference associated with the first request has not been received by the requester.

25. The system of claim 16, wherein the first request is ordered at the home node subsequent to the second request and the second requesting processor is the one of the first

and second requesting processors, the home node being programmed to maintain a transaction associated with the first request in a passive state until transaction information at the home node associated with the second request indicates that the second request has been completed.

26. The system of claim 25, wherein the transaction information at the home node associated with the second request further comprises an indication that the transaction reference message has been received by the second requesting processor and an indication that the home node has received a complete set of at least one response to each of at least one snoop provided by the home node in response to the second request.

27. A processor in a multi-processor network, the processor comprising:
a transaction structure that contains at least a first entry associated with a first request for data issued by the processor, the first entry including a transaction reference field that has a value based on a transaction reference message from a home node for the data, the value of the transaction reference field providing an indication of an order of transactions for the data at the home node; and
a controller that controls how to respond to a second request for the data received from the home node based on the value of the transaction reference field.

28. The processor of claim 27, further comprising a queue capable of storing the second request for cached data, the controller controlling whether the second request for the data is placed in the queue based on the value of the transaction reference field.

29. The processor of claim 28, further comprising an associated cache that includes a plurality of cache lines, the controller enabling the processor to provide a response to the second request for the data based on a present state of the data in a respective one of the cache lines if the transaction reference field has a value indicating that the transaction reference message has not been received from the home node when the second request for the data is received.

30. The processor of claim 28, further comprising an associated cache that includes a plurality of cache lines, the controller placing the second request for the data in the queue for providing a deferred response if the transaction reference field has a value indicating that the

transaction reference message has been received from the home node when the second request for the data is received.

31. The processor of claim 27, wherein the home node provides the transaction reference message to the processor in response to the first request, the requester providing an acknowledgement message to the home node in response to the transaction reference message.

32. The processor of claim 27, wherein the multi-processor network comprises an unordered network that employs a directory-based protocol, the first entry of the transaction structure further including a fill-invalid field, the controller setting the fill-invalid field in response to receiving an invalidate command before the data is received in response to the first request and when the transaction reference field has a value indicating that the transaction reference message has not been received from the home node, the processor being afforded a single use of the data if the fill-invalid field is set.

33. A multi-processor system comprising:

means for providing a transaction reference message substantially in parallel with at least one snoop request from a home node in response to a first request for data from a requesting processor;

means for setting a transaction reference field at the requesting processor in response to the transaction reference message; and

means for responding to at least a second request provided to the requesting processor based on a condition of the transaction reference field when the at least a second request is received.

34. The system of claim 33, further comprising means for deferring a response to the at least a second request from the requesting processor based on the condition of the transaction reference field indicating that the at least a second request is subsequent to the first request.

35. The system of claim 33, wherein the system comprises an unordered network and employs a null-directory cache coherency protocol in which the means for providing a transaction reference message provides a transaction reference for each request that is provided to the home node.

36. The system of claim 33, wherein the system comprises an unordered network and employs a directory-based cache coherency protocol, the home node providing a transaction reference for a selected subset of requests that are provided to the home node.

37. The system of claim 33, further comprising:

means for providing an acknowledgement to the home node from the requesting processor in response to the transaction reference message; and

means for managing requests received at the home node subsequent to the first request based on the acknowledgement from the requesting processor and based on whether a response has been received by the home node for the at least one snoop provided by the home node.

38. The system of claim 33, further comprising means for providing a response from the requesting processor to the at least a second request based on the condition of the transaction reference field indicating that the at least a second request precedes the first request at the home node, the requesting processor providing the response to the at least a second request based on a present state of the data in a respective cache line of the requesting processor.

39. The system of claim 33, further comprising means for deferred processing of a transaction associated with the second request until confirming that the transaction reference message has been received by the requesting processor and that the home node has received a response to each of the at least one snoop request provided by the home node.

40. A method comprising:

providing a fill marker message from a home node in response to a first request for a block of data from a requester;

setting a fill marker status field at the requester in response to the fill marker message from the home node; and

providing a response from the requester to a second request for the block of data that varies temporally based on a condition of the fill marker status field at the requester.

41. The method of claim 40, further comprising issuing at least one forward request for the block of data from the home node concurrently with the fill marker message in response to the first request.
42. The method of claim 41, further comprising:
receiving an acknowledgement at the home node that the requesting processor has received the fill marker message; and
managing requests for the block of data received at the home node subsequent to the first request based on the acknowledgement and based on whether a response has been received by the home node for the at least one forward request provided by the home node.
43. The method of claim 40, further comprising deferring a response from the requester to a second request for the block of data based on the condition of the fill marker status field indicating that the second request has a later order than the first request at the home node.
44. The method of claim 40, wherein the method is implemented in a multiprocessor system employing a null-directory cache coherency protocol, the method further comprising providing a fill marker message from the home node in response to each request for the block of data that is provided to the home node.
45. The method of claim 40, wherein the method is implemented in a multiprocessor system employing a directory-based cache coherency protocol, the method further comprising providing a fill marker message for a selected subset of requests provided to the home node that require the home node to issue at least one snoop for the block of data.
46. The method of claim 40, further comprising queuing a transaction associated with the second request for deferred processing until confirming that the transaction reference message has been received by the requesting processor and that the home node has received a response to each of the at least one snoop provided by the home node.